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Income Inequality and Aggregate Saving

The Cross-Country Evidence

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No evidence is found to support the notion that income inequality affects aggregate saving across countries — neither in developing nor in industrial countries.

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Summary findings

Schmidt-Hebbel and Servén empirically review and analyze the link between income distribution and aggregate savings.

Recent research has focused on the impact of income inequality and growth. Less attention has been paid to the link between inequality and saving. Once the conventional representative-agent framework is abandoned, consumption theory brings out channels through which income inequality can affect aggregate saving.

Schmidt-Hebbel and Servén present new econometric evidence on the link between saving and inequality using new data on income distribution for a large cross-country sample.

The results provide no evidence that income inequality affects aggregate saving across countries. This conclusion holds for both industrial and developing countries and is robust to changes in measures of saving, in income distribution indicators, and in functional forms.

This paper — a product of the Macroeconomics and Growth Division, Policy Research Department — was prepared as part of ongoing research on the determinants of saving. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Emily Khine, room N11-061, telephone 202-473-7471, fax 202-522-3518, Internet address ekhine@worldbank.org. January 1996. (35 pages)

INCOME INEQUALITY AND AGGREGATE SAVING: THE CROSS-COUNTRY EVIDENCE·

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I. Introduction

If all individuals were identical in regard to their saving behavior, then aggregate saving would be trivially related to individual saving -- it would just equal the saving of a representative agent multiplied by the population. Naturally, such a simplistic view of aggregate saving would be highly misleading. It is hard to understand aggregate consumption and saving patterns without considering that they reflect dissimilar behavior by heterogeneous individuals who differ in preferences, resources, and/or institutional constraints. Indeed, consumption and saving are among the few areas in macroeconomics where theoretical developments have occasionally left the safe -- but severely restrictive -- haven of representative-agent models[1] to venture into the wilderness of agent heterogeneity, collecting along the way valuable analytical and empirical insights -- such as those derived, for example, from the life-cycle consumption model.

One particular dimension of heterogeneity that has received increased attention from the macroeconomic viewpoint in recent years is that of income distribution. Recent analytical and empirical work has focused on the relationship between income inequality, growth and investment.[2] Less attention has been paid, however, to the links between income distribution and saving.

These links are the focus of this paper. More specifically, its objective is to ascertain the impact on aggregate saving of changes in the distribution of income among groups of savers, after taking into consideration the effects of other standard variables such as aggregate income and its growth rate. The paper concentrates on the channels through which distribution affects saving. Yet feedback effects from saving to distribution cannot be ruled out *a priori*, and indeed they are central to some of the saving hypotheses (notably those emphasizing the functional distribution of income) that will be reviewed below. Of course, the possibility of two-way causation is not exclusive to income distribution; it applies as well to other standard determinants of saving (income, interest rates, etc.) for which there is a strong presumption that causality may run in both directions. While our discussion touches upon these issues, we do not explore them at length in this paper.

The main conclusion of the paper -- supported by empirical evidence based on new income distribution data constructed by Deininger and Squire (1995) -- is that cross-country data do not reveal any strong association between income distribution and saving ratios. After controlling for other saving determinants, aggregate saving ratios do not appear to be significantly related to standard income distribution indicators. This conclusion holds for a large cross-country sample, as well as for its industrial and developing-country subsamples, and is robust to alternative saving measures, income distribution indicators, and functional forms.

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[1] See Kirman (1992) for a recent sharp criticism of the representative-agent paradigm.

[2] See for example Galor and Zeira (1993), Alesina and Rodrik (1994), Persson and Tabellini (1994), Perotti (1995), and Alesina and Perotti (1996).

The paper is organized as follows. Section 2 presents the stylized facts on saving, income, growth and distribution using data for a large number of industrial and developing countries, and relates the empirical regularities present in our sample to those reported in the literature. Section 3 provides a brief survey of alternative views of saving determination, with emphasis on the saving consequences of different income distribution profiles. Section 4 reviews previous empirical studies of the impact of income distribution on saving, and Section 5 presents new cross-country econometric evidence using our data set. Finally, Section 6 concludes.

II. Saving and Distribution: the Stylized Facts

We begin by reviewing the empirical regularities on saving, income and distribution. To do this, we use annual macroeconomic data on 52 industrial and developing countries from the World Bank databases, and income distribution data from a new database recently constructed by Deininger and Squire (1995). In principle the data cover the years 1965 to 1994 -- although for some countries some of the variables of interest (notably income distribution data) are not available every year within this time span. The discussion focuses on the cross-country dimension of the data, making use of the averages of the relevant variables over the three-decade period above.[3] Unless otherwise noted, here and in the rest of the paper we use the term 'saving' ('saving ratio') to refer to gross national saving (respectively, its ratio to GNP). We choose national saving and national product data as the relevant variables because they are closer to the relevant units (households or individuals) for which income distribution data is available than the domestic saving and domestic product measures. In this respect we differ from most empirical studies, that are based on the less adequate domestic measures.

A preliminary issue that merits comment is that of measurement error. As is well known, this is a central problem in empirical studies of saving, due not only to the inadequacy of the very saving concept used by the National Accounts (which, for example, exclude capital gains from the definition of income, and treat human capital expenditures as consumption) but also to the unreliability of measured saving, which stems largely from the fact that saving is often computed as the residual from another residual (consumption). The upshot is that saving measures may contain large errors, particularly in poorer countries (see Schmidt-Hebbel, Servén and Solimano 1996 for further discussion). Measurement error is even a more serious problem in the case of income

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[3]The sample countries were selected on the basis of availability of income distribution data (kindly made available to us by Klaus Deininger and Lyn Squire) and the following criteria. The 1965-94 average for each country is computed over those years for which the information is available. To ensure the long-term nature of the averages, the sample includes only those countries with at least one income distribution observation in each of two of the three decades that span the 1965-94 period. This leaves us with 20 industrial and 32 developing countries, out of the 20 industrial and 66 non-transition developing countries in the data base of Deininger and Squire. More details are given in the data appendix in this paper.

distribution statistics. The latter are primarily derived from household survey data, which typically understate the income of the richer households. As a result, income inequality is likely to be underestimated. Although no firm evidence is available, most observers would probably agree that such underestimation again is probably more severe in poorer countries, because the statistical apparatus involved in the collection of household data is likely to be weaker.

Keeping in mind these limitations of the available data, we turn to the review of the stylized facts. Since our income distribution information is new, we first provide some summary statistics (a detailed description is given in Deininger and Squire 1995). Table 1 presents means and standard deviations of three conventional indicators of inequality: the Gini coefficient, the ratio between the income shares of the richest 20 percent and poorest 40 percent of the population, and the income share of the 'middle class', defined as the middle 60 percent of the population (which is often used as an indicator of equality). The statistics are computed for three country groups: industrial countries, developing countries, and, as a subset of the latter, the so-called 'take-off' countries. The latter group is defined as consisting of those developing countries that during the sample period successfully shifted from a low to a high saving and growth path.[4]

As Table 1 shows, developing countries are more unequal than industrial countries by any of the three indicators presented. Take-off countries, however, possess on average an income distribution more equitable than the rest of developing countries, also by all three indicators considered.

The stylized facts

The first stylized fact concerns the relationship between saving ratios and level of development -- as measured by real per capita GNP. Figure 1 presents the scatter plot of the 1965-1994 averages of these two variables for the sample countries; using per capita income at the initial year of the sample instead of its average value yields a very similar picture. In the figure, countries appear clustered in rough correspondence to their development level. On average, saving rates are lower for developing countries than for industrial countries. The exception are the take-off economies in our sample, whose saving ratios exceed even the industrial-country average.

The figure shows that saving rates tend to rise with per capita income: the correlation coefficient between the two variables is .31, significantly different from zero at the 5 percent level, and is even higher (.60) among developing countries. (See the matrix of correlations between the saving rate and related variables in Table 2).

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[4] The group includes China, seven market-economy East-Asian countries (Hong-Kong, Indonesia, Korea, Malaysia, Singapore, Thailand and Taiwan (China)), Chile, and Mauritius.

A similar association has been found in a number of empirical studies of saving (e.g., Collins 1991; Schmidt-Hebbel, Webb and Corsetti 1992; Carroll and Weil 1994; Masson, Bayoumi and Samiel 1995; Edwards 1995).

The figure also suggests that at high levels of per capita income saving ratios appear to level off -- i.e., the relationship is not linear, and possibly not even monotonic. As a more formal check on this, the solid line in Figure 1 plots the fitted values from regressing the saving rate on a quadratic polynomial in per capita income; the estimated coefficients are significant at conventional levels. The fitted curve shows that the positive association between saving and development appears indeed to be confined to the early stages of development, ceases to hold at about $8,000 per capita GNP (in 1987 US$), and turns into a negative association at higher income levels.

A second stylized fact is the strong positive association between saving ratios and real per capita growth, which has been amply documented in cross-country empirical studies.[5] However, its structural interpretation remains controversial, as it has been viewed both as proof that growth drives saving (e.g., Modigliani 1970, among many other studies) and that saving drives growth through the saving-investment link (e.g., Levine and Renelt 1992; Mankiw, Romer and Weil 1992).[6]

As Figure 2 shows, our data conform to these findings. Aggregate saving ratios and real per capita GNP growth are positively associated, and their correlation coefficient equals .63, significantly different from zero at the 5 percent level. However, the figure also suggests that this relationship might be driven by the fast-growing, high-saving take-off economies, most of which are clustered at the upper-right corner of the graph. In fact, if these countries are removed from the sample, the correlation drops to .40, but still remains significant.

Is the association between saving and income distribution as clear-cut as that between saving and income (or its growth rate) ? Figure 3, which plots saving ratios against Gini coefficients of income distribution, shows a less clear-cut pattern than the preceding two figures. Nevertheless, the full-sample correlation between both variables is -.28, just statistically significant at the 5 percent level. The correlation pattern is, however, rather different in the industrial (.10) and developing-country (-.26) subsamples; in neither is it significantly different from zero. Interestingly, the figure also reveals a sharp distinction between both sets of countries from the point of view of inequality: virtually all non-take-off developing countries possess a more unequal income distribution (as measured by the Gini coefficient) than that of the most unequal OECD country.

The above facts lead to the much-discussed relationship between income inequality and level of

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[5] See for example Modigliani (1970), Maddison (1992), Bosworth (1993) and Carroll and Weil (1994).

[6] On the saving-growth causality see the recent overviews by Carroll and Weil (1994), Deaton (1995), and Schmidt-Hebbel, Serven and Solimano (1996).

development -- with the latter measured as before by real per capita GNP. According to the well-known finding by Kuznets (1955), the relationship between these variables follows an inverted-U shape: inequality rises in the early stages of development, and then decreases as per capita income continues to rise. This stylized fact has been replicated to varying extents in a number of cross-country studies (for recent examples see Bourguignon and Morrison 1990, and Clarke 1991), but its interpretation is far from clear (see Adelman and Robinson 1989, for a discussion).[7]

Figure 4 shows that our sample fits the Kuznets curve. Keeping with convention, the figure plots Gini coefficients against the log of per capita income (with both variables measured by their 1965-92 averages). The curved line in the graph depicts the fitted values from regressing the Gini coefficient on the log of per capita income and its square; the estimated coefficients are highly significant. As can be seen from the figure, developing countries account for the upward-sloping portion of the empirical curve, and industrial countries cluster along the declining portion.

One methodological issue that arises is whether the above findings are sensitive to our choice of the Gini coefficient as the relevant statistic. A number of alternative indicators are found in the literature -- e.g., Theil's index, the coefficient of variation of income across households, the income share of the poorest 20 or 40 percent of the population, the ratio of the latter to the income share of the richest 20 percent, or the income share of the middle class.[8] Among all them, the Gini coefficient, Theil's index or the coefficient of variation are generally preferable because they use more information than the commonly-encountered quintile-based indicators. At the same time, the Gini index has the well-known drawback that it is not uniquely related to the shape of the underlying distribution, so that very different redistribution schemes can be reflected in the same change in the Gini coefficient. Finally, income shares (in levels) and Gini coefficients may pose cross-country comparability problems, likely to be minimized by the use of share ratios (Deininger and Squire, 1995).

In practice, however, the informational content of all these indicators is usually very similar, as shown by the fact that they typically are very highly correlated -- even though they may yield different orderings for a few sample observations (see for example Clarke 1991). This applies also in our case. By way of example, Figure 5 plots the Gini coefficient against the ratio of the income share of the richest 20 percent of the population to that of the poorest 40 percent, for those countries in our sample for which both kinds of data are available. The plot reveals a strong positive association between both distribution measures; indeed, their correlation coefficient

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[7] As is well known, Kuznets' explanation of his empirical finding was based on the shift of population from traditional to modern activities. See Anand and Kanbur (1993) for an analytical reassessment of this view.

[8] For a discussion of the properties of these indices see for example Cowell (1971).

equals .95, so that they are virtually indistinguishable.

To summarize this section, our data conform to three stylized facts found in cross-country studies. First, saving rates appear to rise with development (as measured by per capita GNP) -- at least at its early stages. Second, saving rates and growth rates are positively correlated across countries. Third, income inequality seems to rise at early stages of development, and decline beyond certain levels of per capita income, as predicted by the 'Kuznets curve'.

For the overall sample, we also find a negative association between aggregate saving rates and standard measures of income inequality, although the relationship appears weaker than the above 'stylized facts', and is not robust across subsamples. More importantly, this refers only to the simple correlation between saving and income distribution. The more substantive question is whether the association between both variables continues to hold once other standard saving determinants are taken into consideration. To answer this question, we need to examine the theoretical underpinnings of the saving-inequality link, and place the latter in a broader framework encompassing other relevant determinants of saving. This task is undertaken in the next section.

III. Saving and Income Distribution: A Brief Survey

Aggregate saving is the outcome of individual saving efforts by heterogeneous members of different classes of savers. Heterogeneity among savers is a key feature that helps understand how aggregate saving is affected by changes in saving determinants, including policies. Heterogeneity may be related to the fact that different types of individuals determine their consumption/saving plans according to different objectives (i.e., their preferences are not identical). Alternatively, even if all individuals possess identical preferences, their behavior may differ because they face different institutional constraints (e.g., in their access to borrowing), or behavior may vary depending on the values of exogenous variables relevant for their consumption/saving decisions (e.g., no saving can be made below a certain threshold of income needed for subsistence).

Heterogeneity is of course important because when agents are dissimilar the aggregate levels of those variables relevant for *individual* saving decisions are not sufficient to determine *aggregate* saving -- the latter also depends on the distribution of such variables across individual savers. Even if all agents had identical preferences, distribution still matters as long as their (common) decision rule for saving is not linear in the relevant variables. In such case, a given change in the aggregate value of a saving determinant (such as disposable income or wealth) can have very different consequences for aggregate saving depending on how it impacts different types of savers. Likewise, purely redistributive policies can have an impact on aggregate saving -- e.g., public transfers to the poor financed by taxes on the rich may reduce total saving if the former have a higher propensity to spend than the latter.

Below we review briefly the literature on consumption and saving determination, with a focus on income (or wealth) distribution in particular. We adopt an aggregate perspective, although some reference is made to the distinction between private and public saving, or firm and household saving, where relevant. Our approach is selective rather than exhaustive. We first examine the relationship between saving and three basic determinants: income, the rate of return, and uncertainty[9]. Then we highlight different channels through which distribution affects the relationship between these two basic variables and aggregate saving. We conclude with some brief remarks on the influence of standard economic policies on saving, discussing how their impact is affected by distributive factors.

III.1 Basic saving determinants

Income

Income or wealth is the main driving force behind consumption (and hence saving) and therefore has attracted the largest attention among all potential saving determinants. But beyond this very general statement there is very little in common among different saving theories. The differences start with the appropriate measure of income: current income (in the conventional Keynesian hypothesis, henceforth KH), permanent income net of taxes over the life-cycle (the life-cycle hypothesis, LCH), permanent income net of taxes over an infinite horizon (the permanent-income hypothesis, PIH) or, as a variant of the latter, permanent income net of government spending over an infinite horizon (REH, the Ricardian-equivalence hypothesis).

As a starting benchmark consider either the PIH or its REH variant for a representative consumer.[10] A rise in net permanent income leads to a proportional increase in consumption levels without any effect on saving. Temporary income changes are smoothed out through appropriate levels of saving. If both current and permanent income rise by the same amount, consumption and saving ratios to current income remain unaltered; in turn, purely temporary income changes result in movements of the saving (consumption) ratio in the same (opposite) direction.

According to the PIH, income growth -- i.e., the increase of future income relative to current income levels -- must reduce saving rates, as consumers raise current consumption in anticipation of higher future income. This, however, is at odds with the positive saving-growth correlation observed in the data and reviewed

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[9] Uncertainty refers basically to the variability of income and the rate of return, and therefore is really not a separate variable. However, because the literature emphasizes the distinction between the effects on saving of income (or rate of return) variability and those of their respective levels, we treat them separately.

[10] See Friedman (1957), Hall (1978) and Flavin (1981).

in the previous section, and has prompted several lines of research attempting to explain why rational consumers may fail to adjust their consumption levels in the face of rising income.[11] The explanations are mostly based on non-standard preferences incorporating consumption habits (which prevent rapid changes in consumption levels), subsistence consumption levels (below which no saving whatsoever takes place, so that the saving propensity is effectively zero) or wealth as an argument of the utility function (the classical "capitalist spirit" model). Under each of these formulations, higher income can generate increases in saving, at least transitorily. On the other hand, as we shall see later, once the representative-agent framework is abandoned, some of these preference specifications provide possible channels through which income distribution could affect overall saving.

At the other end of the theoretical spectrum is the LCH of Modigliani and Brumberg (1954, 1979) -- the main competitor of the PIH-REH theories. As opposed to the representative-agent framework of the latter, agent heterogeneity is the cornerstone of the LCH. Aggregate saving results from the addition of saving by different age-specific cohorts. Each cohort smooths consumption over a finite horizon, given lifetime resources that -- in the simple LCH hypothesis -- are not transferred across generations. Over the life cycle, saving and consumption follow hump-shaped patterns, with dissaving at young age, the peak of saving at working age, and dissaving during retirement as households run down their accumulated assets. Hence saving propensities depend on age and differ systematically across cohorts.

The impact of growth on saving in the LCH framework is ambiguous. On the one hand, the earnings and saving of the working-age population will rise relative to retirees' dissaving, thus pushing up aggregate saving. On the other hand, however, workers will anticipate higher earnings during their working age, and this will depress their saving just like in the PIH framework. The overall effect is therefore indeterminate.

As mentioned earlier, there is of course an alternative interpretation of why standard models of saving have such a hard time generating a positive growth-saving association. Rather than saving behavior, the latter could just reflect the combination of two well-established empirical facts: the positive association between investment and growth (Levine and Renelt 1992) and the equally positive saving-investment correlation (Feldstein and Horioka 1980, Feldstein and Bachetta 1990), often interpreted as evidence of international capital immobility (see Schmidt-Hebbel, Servén and Solimano 1996).

The rate of return

The second key factor governing the intertemporal allocation of consumption, and hence saving, is the rate of return. However, its impact on saving in the representative-agent framework of the PIH is ambiguous,

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[11] See Carroll and Weil (1994) and Deaton (1995).

because changes in the rate of return have both income and substitution effects, which run in opposite directions (except in particular cases, like when the consumer is a net debtor). The situation is similarly ambiguous in the LCH framework. Here changes in interest rates entail transfers among cohorts, and the net impact on aggregate consumption and saving depends on the different cohorts' saving propensities as well as on their relative size (see Deaton 1992). In practice, empirical studies support these theoretical ambiguities, and typically fail to find significant effects of interest rate changes on saving.

Recent work by Ogaki, Ostry and Reinhart (1994) adds a new dimension to the effect of the rate of return on saving. They present a model in which the elasticity of intertemporal substitution (and hence the interest rate sensitivity of saving) rises with the level of income. Empirical estimation of the model on a cross-country data set provides some support for this view.

Uncertainty

Recent work on saving has moved away from the simple versions of the PIH and LCH models toward broader frameworks incorporating uncertainty about future income, the rate of return to savings, the length of life, etc. One line of work has relaxed the certainty-equivalent utility function of Hall's (1978) PIH, allowing the marginal utility of consumption to be nonlinear, typically convex. This convexity creates precautionary motives for saving whenever uncertainty about future consumption is introduced: it is prudent for individuals to limit borrowing and not consume too much until they know more about their future -- an effect that is stronger the greater the uncertainty about lifetime income.[12]

The existence of the precautionary motive for savings is less in doubt than its actual magnitude. While empirical testing has been limited, it is likely that precautionary saving may represent well the short-term consumption-smoothing behavior of the average consumer, but not explain the bulk of saving, which in most societies appears to be carried out by a relatively small number of wealthier households (see Carroll and Summers 1991 and Deaton 1995).

III.2 Income distribution and saving

Let us now focus in more detail on the impact of changes in the distribution of income (or wealth) on aggregate saving. We examine four topics: (i) links between saving and the *functional* distribution of income;

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[12] Unlike in the simple PIH, in this framework intertemporal transfers of resources that leave the present value of lifetime income unaffected can still affect saving behavior. Higher present taxes with lower future taxes lead to a decline in consumption if individuals have to rebuild their precautionary balances (and cannot borrow against the future tax break).

(ii) links between saving and the *personal* distribution of income; (iii) liquidity constraints, distribution and saving; and (iv) indirect effects of distribution on saving.

Functional distribution and saving

The link between the functional distribution of income and saving (and growth) is at the heart of the neoclassical growth model (Solow 1956), as well as the neo-Keynesian growth models of Lewis (1954), Kaldor (1957) and Pasinetti (1962). These models are general-equilibrium in nature, with both saving and income distribution as endogenous variables.

Unlike the neo-Keynesian models, in the neoclassical framework workers and capitalists do not necessarily differ in their saving patterns. Aggregate saving behavior in conjunction with production characteristics determines income distribution. The reason is that saving influences investment and thus the capital stock. An increase in the propensity to save will increase the long-run capital-labor ratio, and capital's income share will rise or fall depending on whether the elasticity of factor substitution is greater or smaller than one, respectively.

By contrast, the neo-Keynesian growth models of Lewis and Kaldor assume from the outset that workers and capitalists have different saving behavior.[13] Lewis (1954) argues that most saving comes from the profits of the entrepreneurs in the modern, industrial sector of the economy, who save a high fraction of their incomes, while other groups in the economy save less. The more fervent the activities of the capitalists, the faster does the distribution of income tilt toward profits, increasing the aggregate saving ratio. Income redistribution from the low-saving group to the entrepreneurs raises aggregate saving.

Likewise, in the simplest form of Kaldor's (1957) model, workers spend what they earn (their propensity to save is zero) and the share of profits in national income depends positively on the investment-output ratio and inversely on the propensity to save of the capitalists. Thus, like in Lewis' model, an increase in investment raises the income share of profits at the expense of the wage share, and the more the capitalists spend, the more they earn -- the "widow's cruse" is never empty.

Pasinetti (1962) assumes that saving propensities differ among classes of individuals, rather than classes of income. Workers' saving is not zero; indeed, they are assumed to own shares on the capital stock and receive part of the profits. Nevertheless, the implications for the share of profits in income are the same obtained by

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[13] See Marglin (1984) for in-depth analyses of the classical, neoclassical, no-Marxian, and neo-Keynesian approaches.

Kaldor. The fact that workers save does influence the distribution of income between capitalists and workers, but does not influence the distribution of income between profits and wages.

While these neo-Keynesian models establish a clear relation between the functional distribution of income and saving, it is worth noting that their implications in terms of the inequality-saving link are less automatic. The reason is that in many societies wage earners do not necessarily represent the poorer segments of the population, which are likely to include instead small rural landowners and self-employed individuals in the informal sector. As a result, the association between the functional and personal distributions of income is empirically rather weak (Atkinson 1994).

Personal Distribution and Saving

With consumer heterogeneity, standard consumption theories also generate links between personal income distribution and aggregate saving that, unlike the classical theories just referred to, do not depend on the exogenous distinction of two groups of savers and non-savers. These links result from a non-linear relationship between individual saving and income, which can have different sources, but in most cases -- although not invariably -- leads to a positive relationship between inequality and aggregate saving.

A starting point is again the LCH, amended to include bequests. The latter were absent from the early formulations of the LCH because they were thought insignificant. Only 20 percent of total U.S. wealth was believed to come from bequests, with the remaining 80 percent due to the saving of living individuals. More recent studies have virtually reversed this 20-80 rule to 80-20 (Kotlikoff and Summers 1981, 1988). This is an important finding from the theoretical viewpoint because, with a fully developed intergenerational bequest motive, the distinction between the LCH and the PIH virtually vanishes, as different age cohorts become mutually linked.

The view that bequests as a saving motive are more important than life-cycle considerations, and that the elasticity of bequests with respect to lifetime resources exceeds unity helps explain a number of empirical puzzles on the LCH model (see Deaton 1992 and 1995 for further discussion and references). First, there is little evidence that the old dissave, as implied by the simple LCH; on the contrary, their saving rates appear to be as high or even higher than those of young households. Second, if bequests are a luxury (at least over a relevant wealth range), saving rates should be higher among wealthier consumers and richer countries than in the rest, which empirically seems to be the case. Third, the fact that saving appears to be concentrated among relatively few richer households, who may be accumulating mostly for dynastic motives, is also in agreement with a central role of bequests in driving saving.

If bequests by the wealthy are a chief force behind saving, as this literature suggests, the situation is close to that described by the "capitalist spirit" model mentioned earlier, in which wealth is accumulated for its own

sake (see, for example, Zou 1993), and higher wealth prompts further accumulation -- because consumption and wealth are gross substitutes in the agent's utility function. More generally, the apparent concentration of saving in a small group of richer individuals suggests that a better understanding of their saving behavior is essential to understand aggregate saving patterns.

The key issue is that if the elasticity of bequests with respect to lifetime resources is greater than unity (so that bequests are a luxury good), income redistribution from rich to poor will unambiguously reduce aggregate saving (Blinder 1975). As we shall see later, this view has received some empirical support.

An alternative route through which income distribution may matter for aggregate saving was suggested by Becker (1975). If there are decreasing returns to human capital, the poor will invest relatively more in human capital than the rich. Since human capital expenditures are considered as consumption in standard national accounting, the measured saving rates of the poor will appear lower than those of the rich, even if their "overall" saving rates (including human capital accumulation) are identical.

In turn, precautionary saving also implies a link between distribution and saving. Consumers with low assets tend to compress consumption to avoid running down their precautionary balances, so that their marginal propensity to consume out of income is higher than that of those consumers holding large asset stocks -- they would devote most of any extra income to consumption. Thus redistribution from the wealthy to the poor would depress overall saving. The opposite could happen, however, if the poor face greater uncertainty, are more risk-averse, or have more limited access to risk diversification than the rich; in such circumstances, a transfer from the latter to the former would lead to higher aggregate saving. A related view, advanced by Friedman (1957), holds that, if the cross-sectional distribution of income reflects future income uncertainty, then greater income inequality should raise precautionary saving.

Consumption habits, whose theoretical interest lies mainly in their ability to generate positive saving-growth correlations through the slow adjustment of consumption[14], also have implications for the saving-distribution link. This can be most clearly seen in an LCH framework. Consumption is costlier for young households -- because the habit it induces has to be fed for the rest of life -- and cheaper for old consumers. Thus the young will tend to save more than the old, and income redistribution from the latter to the former will raise overall saving. Redistribution from rich to poor can also raise saving under the (not too implausible) assumption that habits make it more difficult to adjust future consumption down than up. In such case, richer consumers would reduce their consumption level by the full amount of the transfer, while poorer consumers would be reluctant to raise their consumption by the same amount.

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[14] See Carroll and Weil (1994) and Carroll, Overland and Weil (1994).

Borrowing constraints, saving and distribution

The inability of some consumers to borrow forges a powerful link between income distribution and saving. Consumption models with borrowing constraints divide consumers into savers and non-savers. Unlike in the classical models of functional income distribution, however, this does not arise from the exogenous distinction of two classes of people or preferences, but from the distribution of preferences among the population, interest rates, the variability of earnings, and their rate of growth.

Borrowing constraints act in a way similar in many respects to the precautionary saving motive. Given the inability to borrow, consumers use assets to buffer consumption, accumulating when times are good and running them down to protect consumption when earnings are low. In the theoretical models, borrowing constraints mostly affect impatient consumers who face high earnings growth (Deaton 1991).

The empirical relevance of borrowing constraints is well established. However, they help explain mostly short-term saving for consumption buffering, not long-term saving for old-age or for bequests. For example, Hayashi (1985) finds that for a significant fraction of the Japanese population the behavior of consumption over time is consistent with the existence of credit rationing and differential borrowing and lending rates. Borrowing constraints appear particularly important with regard to saving for housing purchases. Jappelli and Pagano (1994) show that credit constraints reflected in housing mortgage regulations are an important explanatory factor behind cross-country differences in saving.

In practice, borrowing constraints affect mostly poorer households, and not the rich who hold large asset stocks. Thus, like the precautionary saving motive, borrowing constraints likely are a chief force behind the saving behavior of lower- and middle-income groups, but not richer households. Income redistribution away from the latter makes the borrowing constraints less likely to bind and reduces the importance of buffer-stock saving, thus lowering aggregate saving rates.

Indirect links

Other recent literature brings out some indirect links between distribution and saving operating through third variables that affect saving. One particularly active line of research is the "political economy" literature, which has underscored the positive association between income equality and economic growth in a framework of endogenous growth and endogenous economic policy[15]. In this approach, causality runs from distribution to

[15] For a general overview of the different strands of the literature on income distribution and growth, see Solimano (1995).

growth via investment. In addition, these models include a political mechanism which provides a link between income inequality and economic policy .

The main line of argument is that a highly unequal distribution of income and wealth causes social tension and political instability (violent protests, coups, etc.); the result is a discouragement of investment through increased uncertainty, along with adverse consequences for productivity and thus growth (Persson and Tabellini 1994, Alesina and Rodrik 1994, Perotti 1995, Alesina and Perotti 1996). In addition, income distribution may affect growth also through taxation and government expenditure: in a more unequal society there is greater demand for redistribution and therefore higher taxation, lower returns to investments in physical and human capital, and less investment and growth.

These arguments have received some empirical support. From the point of view of saving, the implication is that if saving is positively dependent on growth -- or, alternatively, if saving reflects in part the investment decisions of firms -- then higher inequality will, through the above channels, depress aggregate saving -- in contrast with the positive impact of inequality on saving implied by most of the theories examined so far. Additionally, distributive inequality may also tend to lower *public* saving, as governments engage more actively in redistributive expenditures -- as in the populist experiences examined by Dornbusch and Edwards (1991).

It is important to note that the existence of an inverse relationship between inequality and investment, as suggested by the above literature, could also imply a negative association between inequality and saving through firms' earnings retention. The latter is typically the primary source of financing for private investment, so that if higher inequality lowers investment it should also reduce firm saving. What happens with *aggregate* saving, however, depends on whether firm owners (i.e., households) can pierce the "corporate veil" that separates household and firm decisions. If this is the case, a fall in firm saving could be fully offset by a rise in household saving, leaving aggregate saving unaffected.

IV Empirical Studies

Empirical tests of the impact of income distribution on saving are rather scarce. Some early studies followed the Kaldor-Lewis approach and focused on the functional distribution of income. Along these lines, Houthakker (1961), Williamson (1968), Kelley and Williamson (1968) and Gupta (1970) found some evidence that the propensity to save from non-labor income exceeds that from labor income.

More recent empirical studies focus on the effect of personal income inequality on saving. For the most part, they find either no effects or a positive impact, although in the latter case the estimates often are statistically insignificant at conventional levels.

Blinder (1975) uses U.S. time-series data for 1949-1970 to estimate an equation for aggregate consumption including income distribution indicators. He finds that higher inequality appears to raise aggregate consumption (and thus lower saving), although the estimated effect is in general statistically insignificant. He attributes this result to the lack of correspondence between his analytical framework -- which predicts the opposite result -- and his empirical model, and proposes as a preferable empirical test the estimation of separate consumption equations by income class. This suggestion is taken up by Menchik and David (1983), who use disaggregated U.S. data to test directly whether the elasticity of bequests to lifetime resources is larger or smaller for the rich than for other income groups. They find that the marginal propensity to bequeath is unambiguously higher for the wealthy, so that higher inequality leads to higher lifetime aggregate saving.

A related approach is that of Bunting (1991), who uses consumer expenditure survey data for the U.S. to estimate consumption as a function of income level and distribution by income quintile. He finds strong evidence that household spending depends on both the level and distribution of income: the estimated marginal propensities to consume uniformly decline (and propensities to save therefore rise) as the quintile share of income rises. The coefficients are highly significant, and the model explains over half of the variation in household consumption in the sample.

Two early studies by Della Valle and Oguchi (1976) and Musgrove (1980) use cross-country data on both industrial and developing countries to investigate the relationship between saving and income distribution. In both cases the results show no statistically significant effect of income distribution on saving. The exception are the OECD countries included in the study by Della Valle and Oguchi, for which they find some evidence that increased inequality may increase saving; Gersovitz (1988) suggests that their failure to obtain a similar result for the developing countries may be due to poor quality of the corresponding income distribution data. In turn, Lim (1980) finds that inequality tends to raise aggregate saving rates in a cross-section sample of developing countries, but his coefficient estimates are significant at conventional levels only in some subsamples.

Venieris and Gupta (1986) examine the pattern of average saving propensities across income groups in a cross-section sample of 49 countries, using an econometric specification that includes also political instability as a saving determinant. Their results show that poorer households have the lowest saving propensities, but somewhat surprisingly they also find that the highest average saving propensity corresponds to the middle-income group, so that redistribution against the rich may raise or lower the aggregate saving ratio depending on whether the favored group is the middle class or the poor, respectively. However, the interpretation of their results is somewhat unclear due to their use of constant-price saving as the dependent variable, which has no clear analytical justification.

Sahota (1993) tests a reduced-form relationship between saving and income distribution controlling for the effects of per capita income on saving. Using data on 65 industrial and developing countries for the year 1975, he regresses the saving/GDP ratio on the Gini coefficient and a quadratic polynomial in per capita income (he includes also regional dummy variables to remove cultural and habit effects). The parameter estimate on the Gini coefficient is found to be positive, implying a positive impact of inequality on aggregate saving, but the estimate is somewhat imprecise and significantly different from zero only at the 10% level.

More recently, Cook (1995) presents estimates of the impact of inequality on aggregate saving ratios in LDCs from a conventional saving equation including also the level and growth rate of real income, dependency ratios, and a measure of capital inflows. A dummy for Latin American countries is also added to the regressions, although its justification is unclear since no other regional dummies are included. Using decade averages for the 1970s for 49 developing countries, he finds a positive and significant effect of inequality on saving, which appears robust to some changes in specification and to the choice of alternative indicators of income inequality.

Finally, Hong (1995) reports econometric results on the effect of income inequality on gross domestic saving ratios in cross-country samples of 56 to 64 developing and industrial countries, using 1960-85 averages for each country. He finds that the income share of the top 20% of the population has a positive effect on saving rates, controlling for old-age dependency, income (and/or education) level, and income growth.

V Econometric Results

In this section we present new empirical results on the cross-country relationship between saving and income distribution. Our objective is to assess the impact on saving of alternative income distribution indicators, after controlling for income and demographic variables. Our basic sample includes 52 countries (see the data appendix).

We limit ourselves to variants of simple specifications found in comparable cross-country studies of saving (see e.g. Edwards 1995, and Masson, Bayoumi and Samiel 1995). The basic equation to be estimated is the following:

$$(1) \qquad GNS/GNP = \alpha_0 + \alpha_1\, gnp + \alpha_2\, (gnp)^2 + \alpha_3\, growth + \alpha_4\, old + \alpha_5\, young + \alpha_6\, distrib$$

where *GNS/GNP* is the ratio of current-price gross national saving to current-price gross domestic product, *gnp* is real per capita gross national product, *growth* is the (geometric) average annual rate of growth of real per capita gross national product, *old* is the old-age dependency ratio (ratio of population of age 65 and above to total

population), *young* is the young-age dependency ratio (ratio of population of ages 0 to 15 to total population), and *distrib* is an income distribution variable.

The basic specification in (1) embeds both a linear and a quadratic term in real per capita income to encompass the non-linear relation between the saving rate and income described in section II; accordingly, we should expect $\alpha_1 > 0$, $\alpha_2 < 0$. All other variables enter linearly in our basic equation[16]. The majority of empirical studies suggest that the coefficient on *growth* should be positive, while those on the dependency ratios should be negative, according to standard life-cycle arguments.[17]

As income distribution indicator we use the Gini coefficient, although we present also some regressions using instead the ratio of the income share of the poorest 40 percent of households to that of the richest 20 percent, and the income share of the middle 60 percent of the population. The latter variables, however, are available only for a smaller sample.

The correlation matrix of our basic set of regressors in Table 2 shows three striking features. First, as mentioned above, all three income distribution indicators are very highly correlated with each other, with correlation coefficients in all cases exceeding .90 in absolute value. Second, the (negative) correlation between young-age and old-age dependency ratios is also very large (-.93). Third, both dependency ratios are closely correlated with real per capita income (the corresponding correlation coefficients exceed .88). It will be useful to keep in mind these features of the data for the discussion of the empirical results below.

Table 3 shows estimation results using the basic equation for a variety of samples. As a benchmark, the first column reports parameter estimates using a specification excluding income distribution indicators. As expected, the second and third rows show that saving ratios rise with income levels (a result also found by Carroll and Weil 1994 and Edwards 1995) but taper off at high income, as indicated by the negative coefficient on squared GNP per capita. Specifically, the estimates in column 1 imply that, if the other variables are set at their sample means, the saving rate peaks (at a level around 22 percent) when per capita income reaches $9,000 (in 1987 dollars).

In turn, the fourth row in the table indicates that saving ratios are positively associated across countries with per capita GNP growth rates. A 1-percent increase in real growth raises the national saving ratio by about

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[16] All variables (except the variability of income defined below) are measured by their means over 1965-1994 (or the available sample, if shorter).

[17] See Leff (1969) and Modigliani (1970). The dependency ratio is often defined to include also the population under 15. See Gersovitz (1988) for an analytical discussion of the effects of these and other demographic variables on saving.

1.5 percentage points. Finally, it can be seen from the fifth and sixth rows in column 1 that both young and old-age dependency ratios have the expected negative effect on national saving rates.

The simple specification in column 1 accounts for nearly 60 percent of the observed cross-country variation in national saving rates. However, the estimated coefficients on per capita income and its square, as well as on the young-age dependency ratio, have rather large standard errors. The obvious reason for this lack of precision is the strong cross-correlation between age-dependency ratios and real income described in Table 2.[18] Indeed, a joint F-test of the null hypothesis that young-age dependency, real income and real income squared have no impact on saving yields a test statistic of 5.49, which overwhelmingly rejects the null at the 1 percent level.

Columns 2-4 in Table 3 augment the specification in the first column using the Gini coefficient as income distribution indicator in different country samples. The sign pattern of the parameter estimates in the first six rows remains unchanged, and the full-sample estimates in column 2 are virtually identical to those in column 1. However, the saving-growth relationship does not appear robust across country groups: it is much stronger among industrial countries (column 3) than in developing countries (column 4) -- the same cross-country pattern found by Carroll and Weil (1994). Controlling for other factors, a 1 percent increase in the growth rate raises national saving ratios by 3.3 percentage points among OECD countries, and by only 1.1 percentage point among LDCs.

The seventh row reports the parameter estimates for the Gini coefficient. They are positive for the full sample and the OECD subsample, and negative for LDCs. In all three cases, however, they are insignificantly different from zero. As before, real income, its square, and the dependency ratios are not individually significant, but F-tests cannot reject their joint significance even at the 1 percent level.

Columns 5 through 7 use as income distribution indicator the ratio of the income shares of the top 20 and bottom forty percent of the population. This results in a loss of seven observations (two industrial countries and five developing countries) due to unavailability of the share data. Apart from a general loss of precision, the estimation results are otherwise very similar to those obtained using the Gini coefficient, as should be expected in view of the very high correlation reported above between the two income distribution indicators.

Columns 8 and 9 of Table 3 show the results of excluding from the sample the group of take-off developing countries, which some might argue are 'exceptional' from the viewpoint of saving (and also growth). For both the full and LDC samples in columns 8 and 9, the main consequence is that the estimated coefficient on growth loses all significance, a finding similar to that reported by Carroll and Weil (1994) when excluding from their sample the East-Asian 'tigers'. In addition, in the LDC sample (column 9) the estimated coefficient on the income distribution indicator becomes larger in absolute value and closer to statistical significance,

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[18] The correlation between real per capita GNP and its square, not presented in Table 2, equals .98.

suggesting a *negative* effect of inequality on saving. The interpretation of this result, however, is a bit unclear. By dropping the take-off countries, we are eliminating eight of the ten highest-saving countries (see Figure 1), so that in effect we are truncating the sample from above. It is well known that in such circumstances OLS estimates are biased, although the direction of the bias is not known in general (e.g., Maddala 1983).

Next we check the robustness of our main result -- that income inequality does *not* affect aggregate saving -- by estimating alternative specifications that have been used in previous studies. Table 4 presents the results using the full sample. The first two columns explore possible non-linear effects of income distribution, interacting the Gini coefficient with real per capita income and adding a quadratic term, respectively. Neither specification proved successful. Column 3 adds income variability to the basic set of regressors, with variability measured by the standard deviation of real per capita GNP around trend relative to the average GNP level; according to the precautionary saving motive, it should have a positive impact on saving ratios. In fact, the estimated coefficient is negative but insignificant. The likely reason is that aggregate income variability is very different from -- actually much lower than -- individual income variability, as shown by Pischke (1995). Column 4 introduces regional dummies, as done for example by Sahota (1993), with industrial countries as the omitted category. However, the dummies are not significant, either individually or jointly (a joint F-test yields $F(3, 42)=0.681$, far below conventional significance levels). The last two columns in Table 4 investigate alternative inequality indicators: column 5 uses the income share of the middle class, and column 6 adds to this the ratio of income shares of the top 20 and bottom 40 percent of the population. In neither case do we find any significant effects on saving.

As a final check on our results, and also to facilitate comparability with other empirical studies, Table 5 presents estimation results using gross domestic saving and real per capita GDP as the relevant measures of saving and income, respectively. The first two columns estimate our basic specification on the full and LDC sample, respectively. As can be seen, the main difference with the estimation results in Table 3 is the loss of significance of income growth as a saving determinant. For the full sample, the parameter estimate on the Gini coefficient is very similar to that reported by Sahota (1993), but falls far short of statistical significance. For the LDC sample, the estimate turns positive (recall that it was negative when using the national saving ratio as the dependent variable), but its precision is extremely poor.

The remaining columns in Table 5 report alternative specifications adding income variability (computed now on the basis of real GDP), regional dummies, and using the ratio of income shares as indictor of distribution. The main novelties are that the estimated coefficient on income variability has the correct (positive) sign, and the

regional dummies are individually significant. In every specification, however, we fail to find any significant effects of income distribution on saving.[19]

Our findings stand in stark contrast to some of the recent empirical literature reviewed above (including Lim 1980, Venieris and Gupta 1986, Sahota 1993, Cook 1995, and Hong 1995) that finds a positive effect of income concentration on saving. Our deviation from this literature -- that seems robust to alternative saving measures and specifications -- is likely due to our use of the new and better cross-country data set on income distribution constructed by Deininger and Squire (1995).

VI Concluding Remarks

Recent theoretical and empirical literature has examined the links between inequality and investment and inequality and growth. However, less attention has ben paid to the relationship between saving and distribution. Yet it is hard to understand aggregate consumption and saving without taking into account the fact that they result from the behavior of heterogeneous microeconomic agents, a fact that makes income distribution a potentially important factor behind overall consumption and saving.

This paper has reviewed analytically and empirically the link between income distribution and aggregate saving. While systematic explorations of this issue have been mostly confined to Neo-Keynesian growth models, the paper has argued that, once the conventional representative-agent framework is abandoned, consumption theory brings out a number of channels through which income inequality can affect saving. Further, in most cases the relationship that arises can be expected to be positive, so that on theoretical grounds higher inequality is, *ceteris paribus*, likely to be associated with higher saving.

The paper has also presented new econometric evidence on the saving-inequality link. Using a new data set on income distribution for a large cross-country sample, on the whole we do not find evidence of any significant association between standard inequality indicators and saving ratios, once other key saving determinants are taken into consideration. This conclusion holds for a variety of samples, income distribution indicators, and empirical specifications.

There are, however, some caveats that make our empirical results tentative. First, because of the unavailability for most countries of long time-series on income distribution, only the cross-country dimension of the data has been exploited here. While this entails some loss of information, it is well known that income distribution indicators generally display little variation over time relative to that across countries, and thus on the

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[19] The same result was obtained in other regressions (not reported) using alternatively the income shares of the top 20, middle 60, and bottom 40 percent of the population as inequality indicators.

whole we do not think that omission of the time dimension has any major consequences for our results. Second, our empirical estimates -- like those reported in the vast majority of the literature on saving -- are based on the implicit assumption that causality runs from income, growth and distribution to saving. While we are aware of the potential simultaneity between these variables, we also believe that the search for valid instruments is not a trivial task, and we leave it for future work. Third, related to this, our empirical estimates focus only on the *direct* effects of inequality on saving ratios, ignoring possible indirect effects operating through other saving determinants -- like, for example, the negative impact of inequality on growth that the recent political-economy literature suggests. To explore the *total* effect of inequality on saving in a satisfactory manner one would need an analytical and empirical framework encompassing these indirect channels.

Ideally, the starting point to address the latter two caveats would be to specify a complete theoretical model describing, as a minimum, the determination not only of saving, but also of the distribution of income and its growth rate. This, however, is likely to be a formidable task, well beyond the scope of this paper.

Data Appendix

The variables introduced in sections II and V and their definitions and sources are the following:

Variable Name	Definition and Source
Gross domestic saving ratio	gross domestic savings relative to gross domestic product in current prices, average over 1960-94; The World Bank
Gross national saving ratio	gross national savings including net current transfers relative to gross national product in current prices, average over 1965-94; The World Bank
Real GDP per capita	in constant 1987 U.S. dollars, average over 1960-94; The World Bank
Real GNP per capita	in constant 1987 U.S. dollars, average over 1965-94; The World Bank
Real GDP per capita growth rate	average over 1960-94

Real GNP per capita growth rate	average over 1965-94
Gini coefficient and Income Share of Top 20% / Bottom 40% of Population	average over 1965-94; Deininger and Squire
Income share of Middle 60% of Population	average over 1965-94; Deininger and Squire
Old age dependency ratio	population aged 65 and over relative to total population, average over 1965-94; The World Bank
Young age dependency ratio	population aged 14 and below relative to total population, average over 1965-94; The World Bank
GDP variability	ratio of standard deviation of residuals of regression of real GDP per capita on time trend to real GDP; authors'calculation.
GNP variability	ratio of standard deviation of residuals of regression of real GNP per capita on time trend to real GNP; authors'calculation.

The number of countries in the full sample is 52. The country classification is the following. **OECD countries**: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. **Take-Off countries**: Chile, China, Hong Kong, Indonesia, Korea (Rep.), Malaysia, Mauritius, Singapore, Thailand and Taiwan, China. **Other developing countries**: Bangladesh, Brazil, Colombia, Costa Rica, Dominican Republic, Egypt, Guatemala, India, Jamaica, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, Sri Lanka, Tanzania, Trinidad & Tobago, Tunisia, Turkey, Venezuela, Zambia.

Not all countries have Gini and Income Distribution measures available for each year. Countries are included in the sample only if they have at least one observation in each of two different decades. The distribution of countries according to the number of annual observations is the following: 38 (31) countries with less than 10 Gini (Income Distribution) observations, 11(11) countries with 10 to 20 Gini (Income Distribution) observations, and 3 (3) countries with more than 20 Gini (Income Distribution) observations.

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Table 1

Income Distribution Indicators: Descriptive Statistics

	Number of Observations	*Gini Coefficient*		*Income Share Ratio of Top 20% to Bottom 40%*		*Income Share of Middle 60%*	
		Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
World	52	39.62	2.70	2.72	0.04	0.48	0.02
OECD Countries	20	33.34	1.92	2.08	0.04	0.54	0.01
Developing Countries	32	43.68	3.17	3.65	0.03	0.45	0.05
of which:							
Take-Off Countries	10	40.31	2.87	2.63	0.04	0.47	0.02
Other Developing	22	45.21	3.31	4.00	0.05	0.43	0.03

Table 2

Correlation Matrix of Basic Regressors

	GNS/GNP	Per Capita GNP	Growth rate of Per Capita GNP	Gini coefficient	Income share of top20/bot40	Income share of middle 60	Old age dependency ratio
GNS/GNP							
Per Capita GNP	0.311						
Growth rate of Per Capita GNP	0.632	-0.001					
Gini coefficient	-0.278	-0.551	-0.238				
Income share of top 20%/bottom 40%	-0.277	-0.469	-0.233	0.951			
Income share of middle 60%	0.335	0.652	0.204	-0.957	-0.919		
Old age dependency ratio	0.177	0.860	-0.012	-0.627	-0.536	0.705	
Young age dependency ratio	-0.394	-0.872	-0.211	0.683	0.603	-0.763	-0.933

Table 3

Cross-Section Estimates of Saving Equations
Dependent Variable: GNS/GNP
(t-statistics in parentheses)

	Equation								
	1	2	3	4	5	6	7	8	9
Sample	Full	Full	OECD	LDC	Full	OECD	LDC	Full W/o Take-Off Countries	LDC w/o Take-Off Countries
Constant	36.506	36.055	28.209	39.844	37.632	30.999	41.447	32.57	52.299
	(2.762)	(2.666)	(1.261)	(2.149)	(2.708)	(1.348)	(2.144)	(2.155)	(2.616)
Real GNP per capita (1987 constant dollar)	0.001	0.001	0.002	0.004	0.001	0.001	0.004	0.002	0.011
	(1.736)	(1.667)	(1.906)	(1.151)	(1.375)	(1.196)	(1.054)	(2.165)	(2.070)
Real GNP per capita squared	-5.67E-08	-5.5E-08	-7.22E-08	-3.26E-07	-4.20E-08	-4.61E-08	-4.13E-07	-7.96E-08	-1.84E-06
	(-1.429)	(-1.376)	(-1.603)	(-0.727)	(-0.979)	(-0.823)	(-0.730)	(-1.903)	(-1.475)
Real GNP growth rate	1.479	1.495	3.265	1.074	1.502	3.202	1.107	0.923	0.341
	(3.055)	(3.042)	(2.757)	(1.779)	(2.843)	(2.687)	(1.738)	(1.308)	(0.729)
Old age dependency ratio	-1.258	-1.253	-0.927	-1.36	-1.271	-0.878	-1.671	-1.188	-2.742
	(-2.643)	(-2.618)	(-1.490)	(-1.061)	(-2.522)	(-1.452)	(-1.106)	(-2.055)	(-1.819)
Young age dependency ratio	-0.413	-0.439	-0.647	-0.402	-0.425	-0.593	-0.455	-0.426	-0.518
	(-1.620)	(1.672)	(-1.218)	(-1.143)	(-1.521)	(-1.219)	(-1.202)	(-1.503)	(-1.631)
Gini coefficient		0.035	0.105	-0.095				0.094	-0.238
		(0.381)	(0.982)	(-0.734)				(1.054)	(-1.613)
Income share ratio of top 20%/bottom 40%					-0.019	0.222	-0.649		
					(-0.033)	(0.165)	(-0.921)		
Adjusted R^2	0.528	0.520	0.539	0.511	0.506	0.525	0.497	0.455	0.413
Standard Error	3.875	3.912	2.691	4.446	4.092	2.817	4.742	3.681	3.458
Number of Observations	52	52	20	32	45	18	27	42	22

Note: The above t-statistics were computed using heteroskedasticity-corrected standard errors.

Table 4

Cross-Section Estimates of Saving Equations
Dependent Variable: GNS/GNP
(t-statistics in parentheses)

	Equation					
	1	2	3	4	5	6
Sample	Full	Full	Full	Full	Full	Full
Constant	38.740	23.249	41.816	33.354	35.140	27.395
	(2.654)	(1.480)	(2.709)	(2.425)	(2.061)	(1.170)
Real GNP per capita	0.001	0.001	0.001	0.002	0.001	0.001
(1987 constant dollar)	(0.517)	(1.614)	(1.211)	(2.032)	(1.402)	(1.251)
Real GNP per capita squared	-5.33E-08	-5.63E-08	-3.76E-08	-6.99E-08	-4.22E-08	-3.84E-08
	(-1.334)	(-1.377)	(-0.933)	(-1.734)	(-0.995)	(1.251)
Real GNP growth rate	1.420	1.453	1.291	1.234	1.497	1.504
	(2.710)	(2.912)	(2.429)	(2.065)	(2.817)	(2.765)
Old age dependency ratio	-1.241	-1.256	-1.349	-0.997	-1.273	-1.287
	(-2.556)	(-2.591)	(-2.638)	(-2.002)	(-2.498)	(-2.471)
Young age dependency ratio	-0.444	-0.484	-0.455	-0.485	-0.407	-0.411
	(-1.656)	(-1.794)	(-1.655)	(-1.736)	(-1.445)	(-1.439)
Gini coefficient	-0.024	0.763	-0.032	0.022		
	(-0.180)	(1.541)	(-0.347)	(0.191)		
Income share ratio of top 20% / bottom 40%						0.548
						(0.526)
Income share of middle 60%					0.038	0.173
					(0.218)	(0.526)
GNP variability			-16.185			
			(-1.317)			
Multiplication of GNP and Gini coefficient	2.15E-05					
	(1.099)					
Gini coefficient squared		-0.009				
		(-1.410)				
Latin America regional dummy				4.413		
				(1.129)		
Africa regional dummy				3.975		
				(1.001)		
Asia regional dummy				5.164		
				(1.403)		
Adjusted R^2	0.516	0.520	0.535	0.508	0.507	0.496
Standard Error	3.925	3.911	3.848	3.960	4.089	4.134
Number of Observations	52	52	52	52	45	45

Note: The above t-statistics were computed using heteroskedasticity-corrected standard errors.

Table 5

Cross-Section Estimates of Saving Equations
Dependent Variable: GDS/GDP
(t-statistics in parentheses)

	Equation					
	1	2	3	4	5	6
Sample	Full	LDC	Full	Full	Full	Full
Constant	39.011	51.769	28.699	40.523	34.594	41.524
	(2.444)	(2.158)	(1.857)	(2.305)	(2.116)	(2.558)
Real GDP per capita	0.002	0.005	0.002	0.002	0.003	0.002
(1987 constant dollar)	(2.260)	(1.615)	(2.792)	(1.199)	(2.897)	(1.965)
Real GDP per capita squared	-7.94E-08	-5.58E-07	-8.44E-08	-7.81E-08	-1.03E-07	-6.49E-08
	(-1.822)	(-1.198)	(-2.008)	(-1.777)	(-2.304)	(-1.353)
Real GDP growth rate	0.430	-0.213	0.582	0.385	0.130	0.447
	(0.664)	(-0.251)	(1.003)	(0.558)	(0.163)	(0.688)
Old age dependency ratio	-1.695	-1.791	-1.574	-1.688	-1.196	-1.695
	(-3.256)	(-1.121)	(-3.121)	(-3.219)	(-2.144)	(-3.026)
Young age dependency ratio	-0.548	-0.716	-0.359	-0.552	-0.644	-0.480
	(-1.812)	(-1.589)	(-1.210)	(-1.780)	(-2.000)	(-1.443)
Gini coefficient	0.149	0.012	0.134	0.117	0.097	
	(1.368)	(0.087)	(1.219)	(0.7340)	(0.673)	
Income share ratio of top 20% / bottom 40%						0.546
						(0.726)
GDP variability			14.945			
			(1.760)			
Multiplication of GDP and Gini coefficient				1.16E-05		
				(0.483)		
Latin America regional dummy					9.324	
					(2.337)	
Africa regional dummy					8.848	
					(1.952)	
Asia regional dummy					9.176	
					(2.540)	
Adjusted R2	0.355	0.323	0.385	0.342	0.373	0.290
Standard Error	4.770	5.447	4.656	4.816	4.704	5.013
Number of Observations	52	32	52	52	52	45

Note: The above t-statistics were computed using heteroskedasticity-corrected standard errors

Figure 1

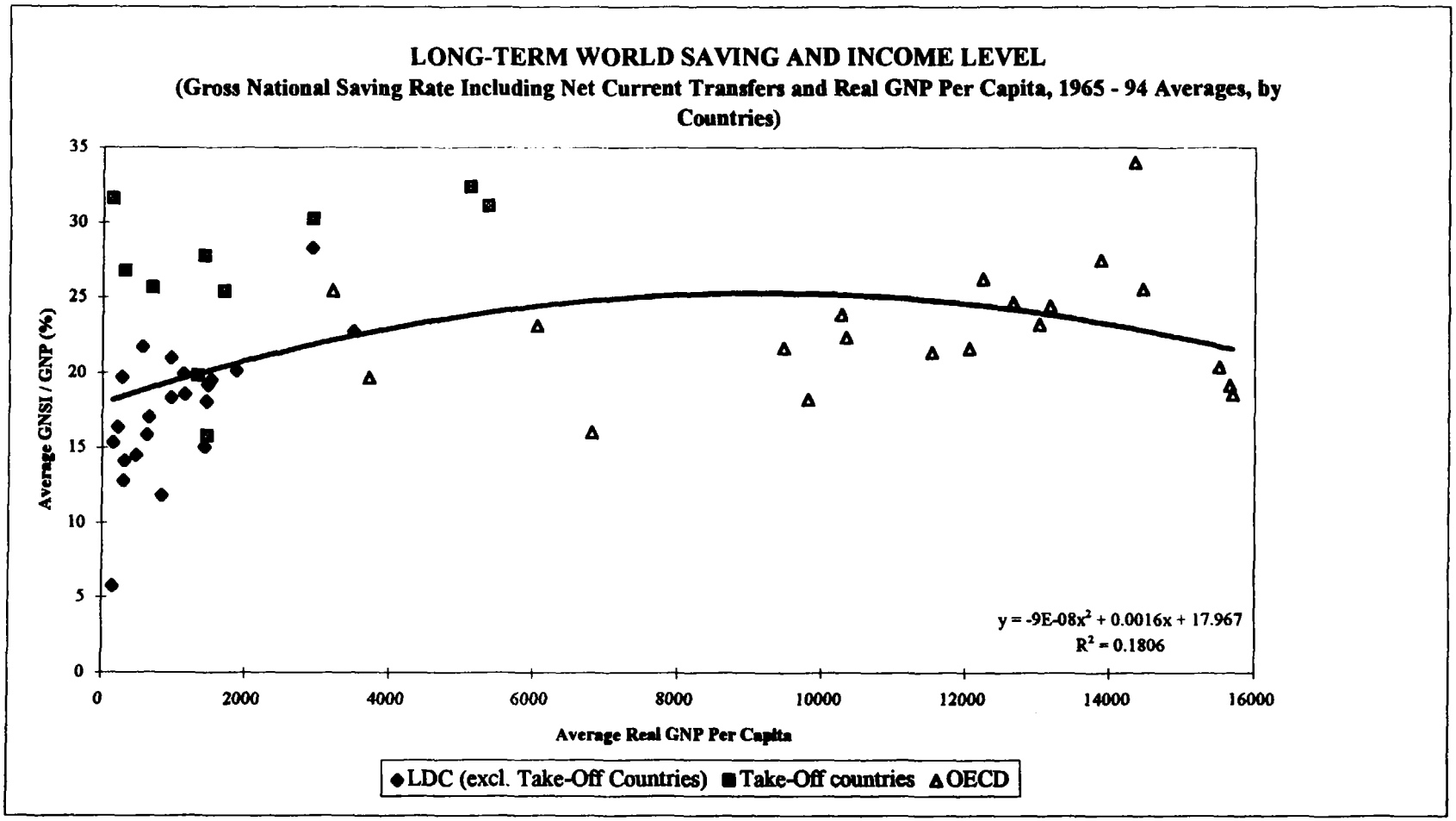

LONG-TERM WORLD SAVING AND INCOME LEVEL
(Gross National Saving Rate Including Net Current Transfers and Real GNP Per Capita, 1965 - 94 Averages, by Countries)
Average GNSI / GNP (%)
35
30
25
20
15
10
5
0
0
2000
4000
6000
8000
10000
12000
14000
16000
Average Real GNP Per Capita
y = -9E-08x² + 0.0016x + 17.967
R² = 0.1806
◆LDC (excl. Take-Off Countries) ■Take-Off countries ▲OECD

Figure 2

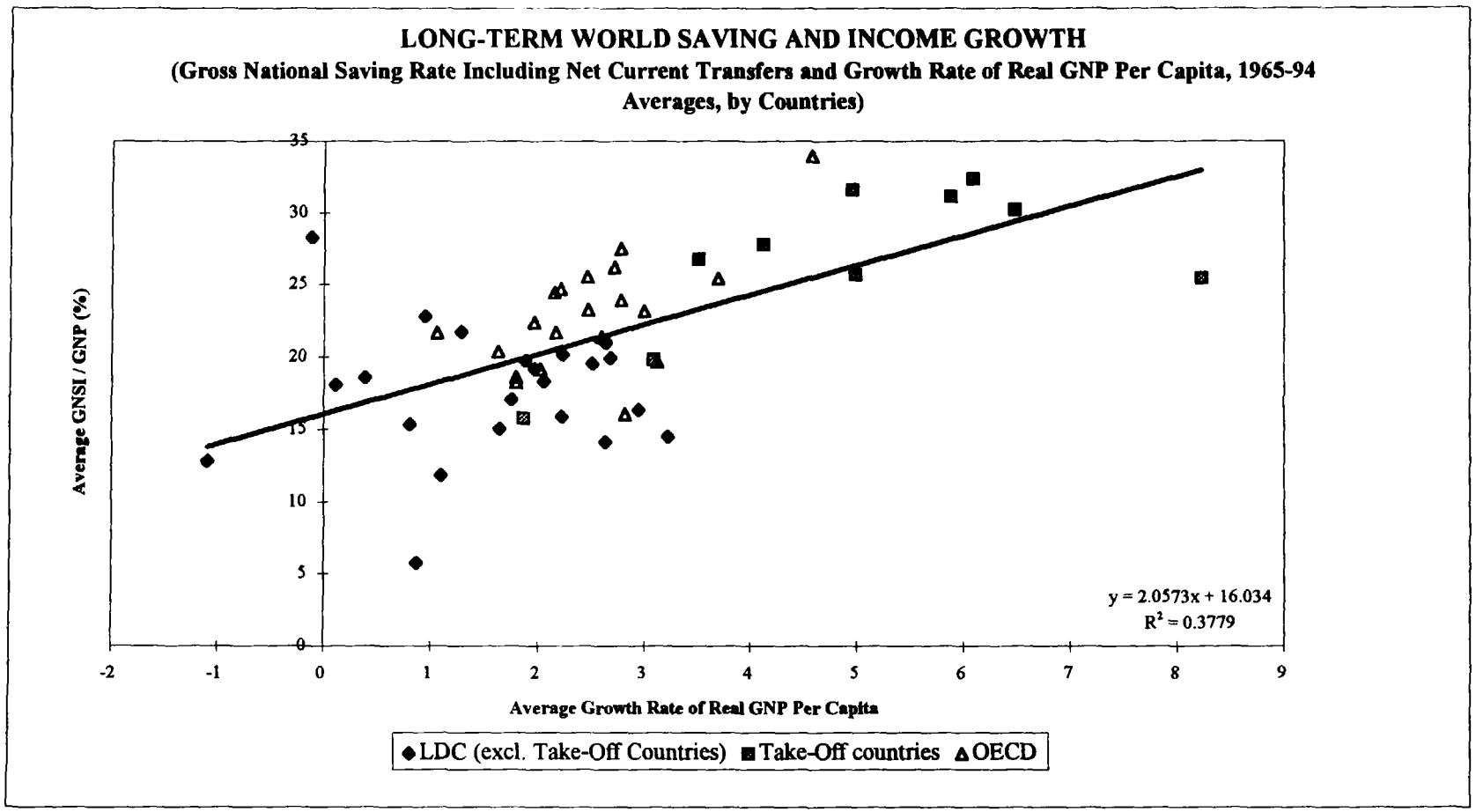

LONG-TERM WORLD SAVING AND INCOME GROWTH
(Gross National Saving Rate Including Net Current Transfers and Growth Rate of Real GNP Per Capita, 1965-94 Averages, by Countries)
Average GNSI / GNP (%)
35
30
25
20
15
10
5
0
-2
-1
0
1
2
3
4
5
6
7
8
9
y = 2.0573x + 16.034
R² = 0.3779
Average Growth Rate of Real GNP Per Capita
◆LDC (excl. Take-Off Countries) ■Take-Off countries ▲OECD

Figure 3

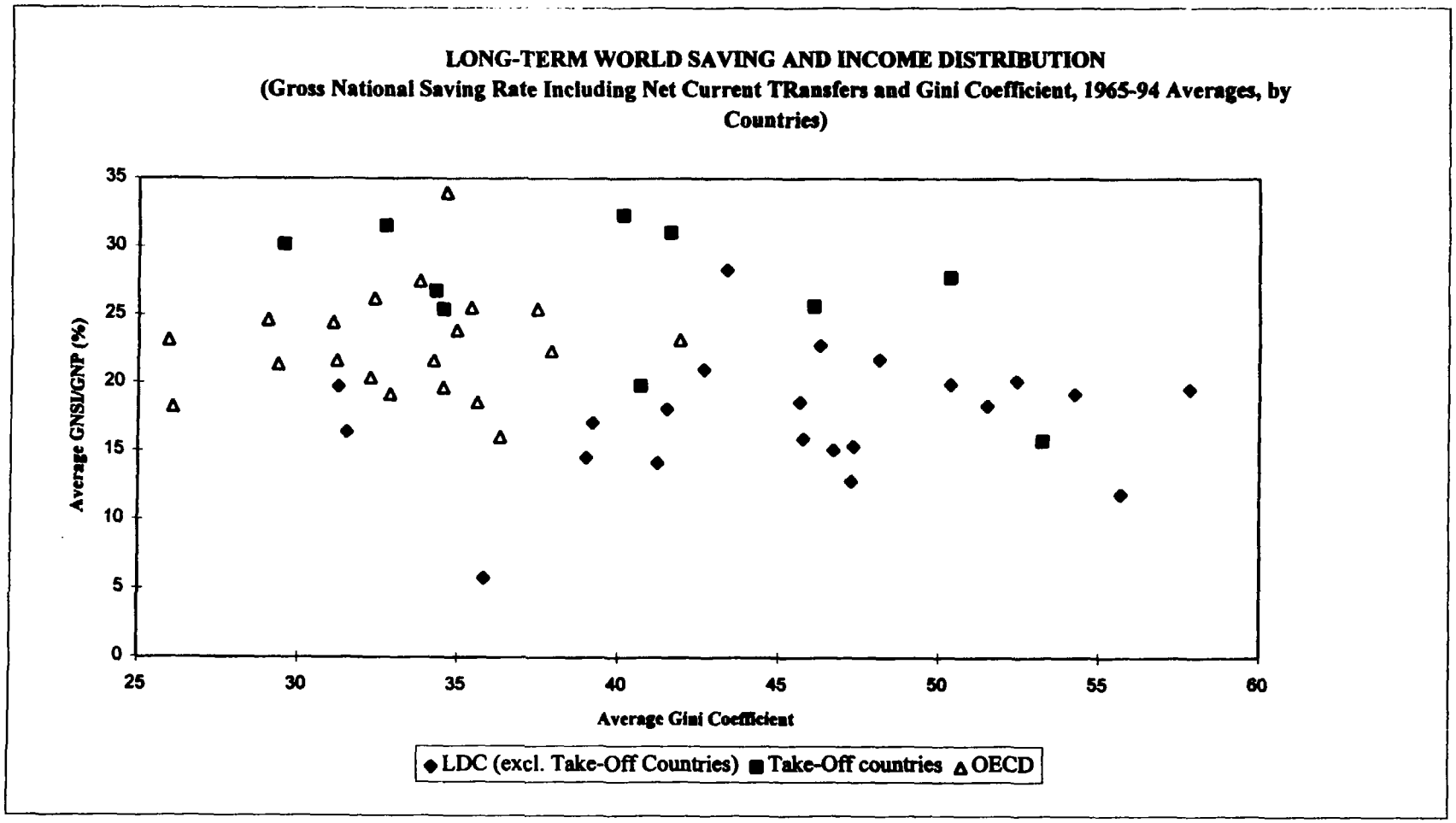

LONG-TERM WORLD SAVING AND INCOME DISTRIBUTION
(Gross National Saving Rate Including Net Current TRansfers and Gini Coefficient, 1965-94 Averages, by Countries)
Average GNSI/GNP (%)
35
30
25
20
15
10
5
0
25
30
35
40
45
50
55
60
Average Gini Coefficient
LDC (excl. Take-Off Countries)
Take-Off countries
OECD

Figure 4

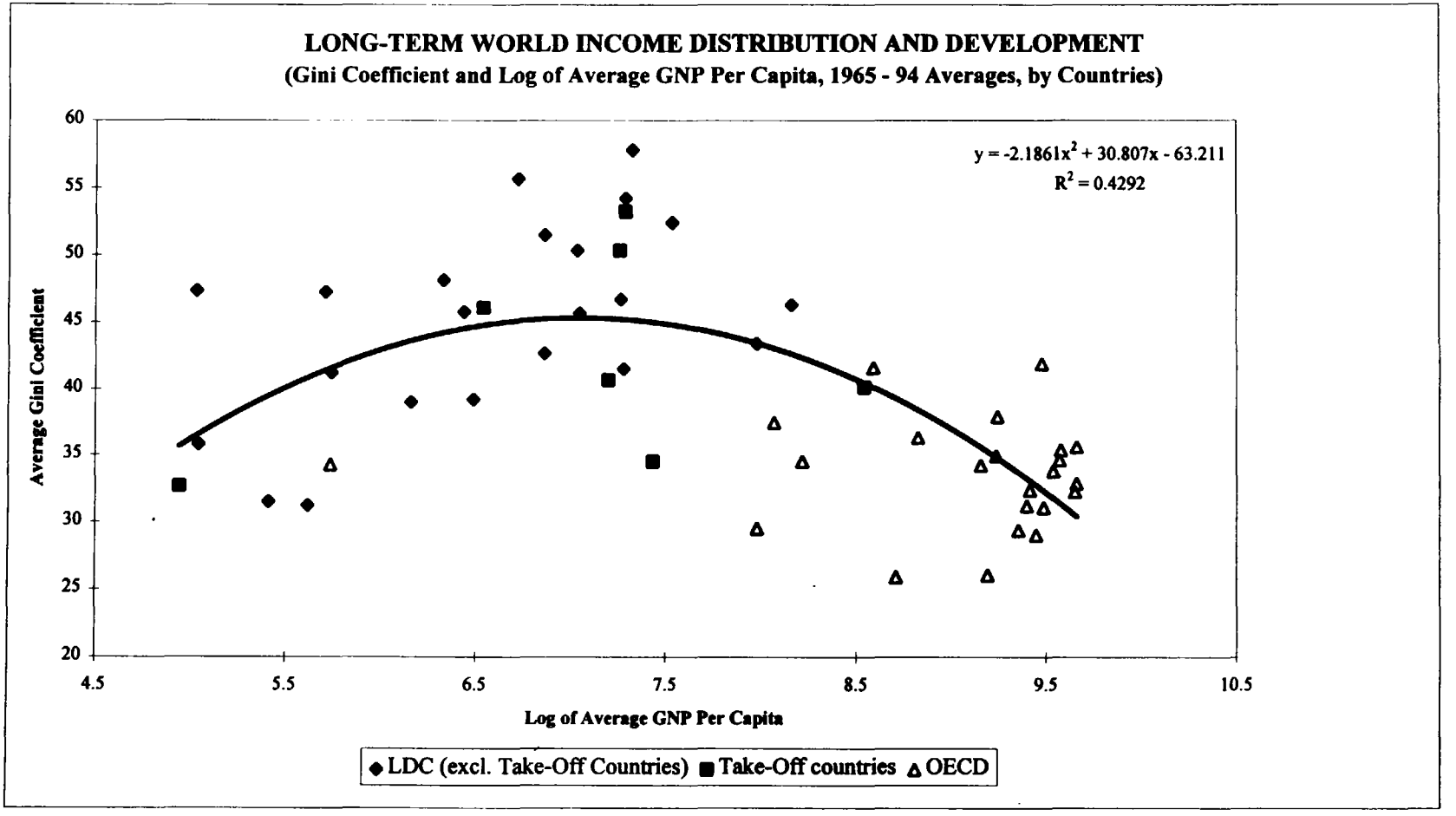
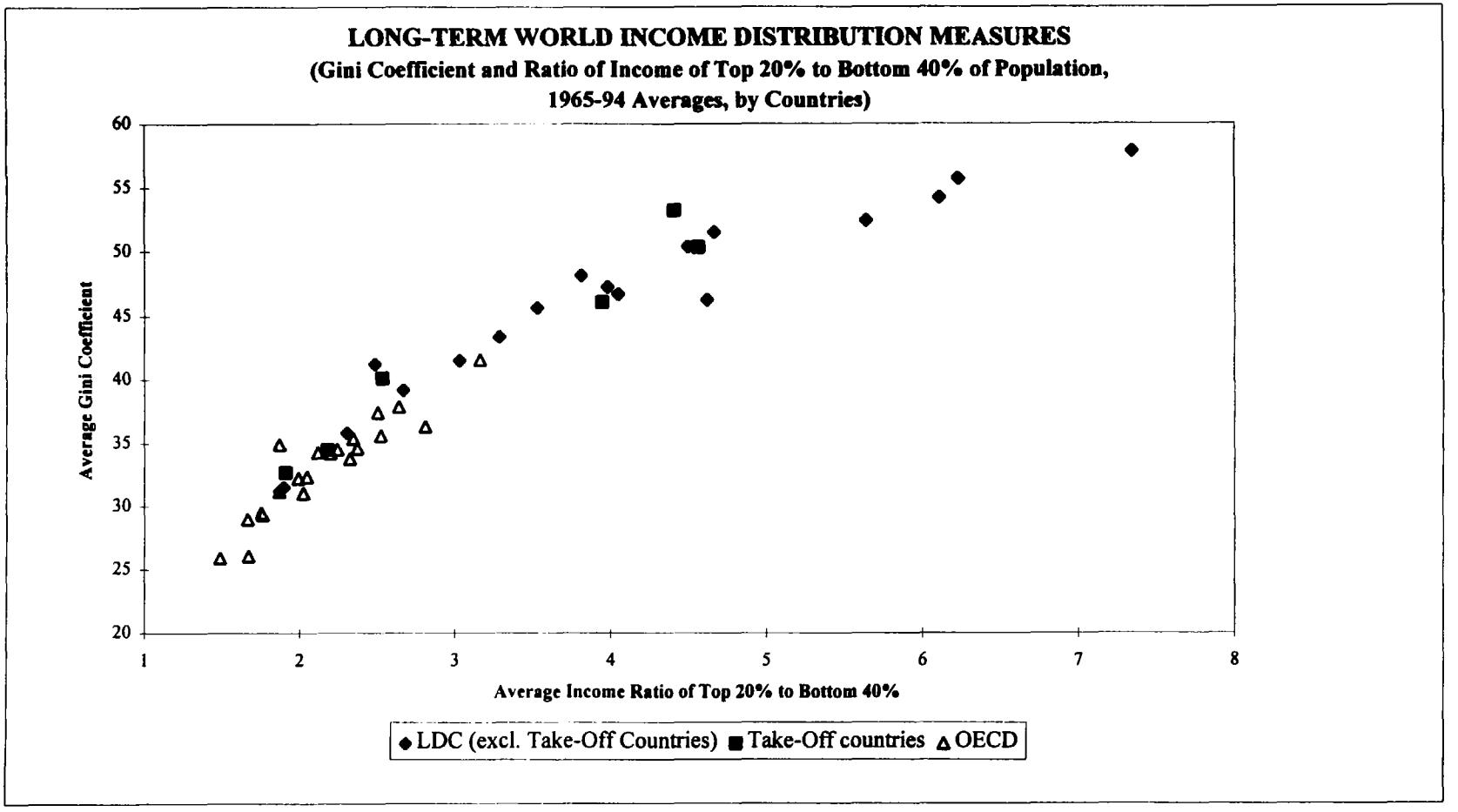

LONG-TERM WORLD INCOME DISTRIBUTION AND DEVELOPMENT
(Gini Coefficient and Log of Average GNP Per Capita, 1965 - 94 Averages, by Countries)
y = -2.1861x² + 30.807x - 63.211
R² = 0.4292
Average Gini Coefficient
60
55
50
45
40
35
30
25
20
4.5
5.5
6.5
7.5
8.5
9.5
10.5
Log of Average GNP Per Capita
LDC (excl. Take-Off Countries)
Take-Off countries
OECD

Figure 5


LONG-TERM WORLD INCOME DISTRIBUTION MEASURES
(Gini Coefficient and Ratio of Income of Top 20% to Bottom 40% of Population,
1965-94 Averages, by Countries)
Average Gini Coefficient
60
55
50
45
40
35
30
25
20
1
2
3
4
5
6
7
8
Average Income Ratio of Top 20% to Bottom 40%
LDC (excl. Take-Off Countries)
Take-Off countries
OECD

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